

An Extraordinary Raccoon, *Procyon lotor*, Density at an Urban Park

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We report on a high density Raccoon (*Procyon lotor*) population at a 70.9 ha urban park in Fort Lauderdale, Florida, where in a 5-day period 160 raccoons were removed and 9 others observed without capture. This represents a minimum density of 238 raccoons/km², and is one of the densest Raccoon populations reported. We discuss the ramifications of high density urban Raccoon populations relative to wildlife disease contagions and endangered species protection.

Key Words: Raccoon *Procyon lotor*, endangered species protection, Florida, Fort Lauderdale, rabies, wildlife diseases.

Hugh Taylor Birch State Park (HTBSP) is in Broward County, Florida, USA, within the limits of the City of Fort Lauderdale. It was initially obtained as public lands by the State of Florida on 31 December 1941. It consists of 56.7 ha of upland vegetation, and 14.2 ha of freshwater and tidal wetlands, for a combined total of 70.9 ha. Terrestrial plant communities consist of disturbed maritime hammock and patchy areas dominated by exotic Australian Pine (*Casuarina equisetifolia*). HTBSP is completely contained within Fort Lauderdale which had a 1990 population census of ca. 150 150 (Fort Lauderdale Community and Economic Development Department), and is surrounded by urban infrastructure to the north and south. The property is bordered to the east by additional infrastructure and the Atlantic Ocean; the Intracoastal Waterway (a large bulkhead canal) truncates the entire western boundary.

Raccoon (*Procyon lotor*) population densities in HTBSP have always been high since the first Southeast Florida district park biologist was hired in 1970 (R. Roberts, personal communication); however, densities were not quantified. During the 1980s, tourists and local residents began the evening practice of feeding Raccoons immediately outside the south boundary of the park, principally at the park drive entrance gate area along the Sunrise Boulevard right-of-way and the contiguous City Fire Station entrance. Although feeding of wildlife is unlawful inside all state parks, until November 2000 it was unregulated outside of HTBSP, including at the entrance. Efforts to control this practice included public environmental education about the detriments of feeding wildlife resources. Coarse, irregular estimates of the Raccoon population at the Park during the late 1990s ranged from 75 to 125 animals (H. Smith, personal observation).

The high density Raccoon population presented a threat of epizootic disease transmission and bites to

humans. High concentrations in urban areas and a willingness to accept food from humans by an animal that many members of the public view as endearing create a much higher probability for human-animal contact than with many other wildlife species. The animals also presented constant vehicular traffic problems in the evenings. A control program was conducted in November 2000 to reduce these hazards by reducing the abundance of Raccoons. Public sentiment restricted the approach to a "one-time only" live-trap and relocate program. This was cooperatively arranged between the Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, and the City of Fort Lauderdale. Raccoons were captured using 80 × 25 × 30 cm Tomahawk live traps (P.O. Box 323, Tomahawk, Wisconsin 54487; use of product names does not constitute endorsement by the U.S. government, nor the Florida state government), baited with cat food.

On the evening of 14 November, 123 Raccoons were captured and relocated by permit to a site south of Homestead, over 88 km away. On the evening of 15 November, HTBSP was again surveyed with 36 Raccoons observed. On the evening of 17 November, 37 additional Raccoons were trapped and relocated to the same site. On the evening of 18 November, active enforcement was initiated of City of Fort Lauderdale Ordinance No. C-00-48, Sec. 6-15 "Feeding of Wild Animals Prohibited." A final survey that evening produced a count of nine raccoons near the park drive entrance gate. Thus, an absolute minimum number of Raccoons inhabiting the park area prior to removal efforts was 169. It is virtually impossible that any of the relocated Raccoons could have returned to be trapped more than once because of the great distance to the relocation site, the habitat, including waterways and bridges they would have to cross through urban Fort

Lauderdale, and the short (5 day) time frame in which all work was completed. Thus, the minimal Raccoon density for HTBSP at the time this work was implemented was 238/km².

Artificially enhanced populations of Raccoons are a problem in wildlands and urban-suburban areas of Florida (Heugel 1991*), and on a more cosmopolitan level (e.g., Rosatte et al. 1992a). Due to the high degree of habitat alteration, fewer species inhabit urban environments than natural environments. However, for those species that inhabit urban environments, increased availability and concentration of food, den sites or other refuges may induce dense populations (e.g., Dickman 1987; Dickman and Doncaster 1987; Riley et al. 1998).

The highest Raccoon density we could find in the literature came from one small (30 ha) section in Rock Creek Park (710 ha total) in Washington, D.C., where the density was estimated as high as 333/km², and estimated Raccoon densities from other study sites in the same park ranged as high as 172/km² (Riley et al. 1998). Estimated densities of raccoons in metropolitan Toronto, Ontario, ranged as high as 140/km² (Rosatte et al. 1992a). The minimal potential density we observed for HTBSP ranks as one of the densest congregations of Raccoons recorded (see Riley et al. 1998 for a range of Raccoon densities). Its Raccoon density was over 4 to 200 times as great as reported rural Raccoon densities (0.9-55.6/km²) (Mech et al. 1968; Johnson 1970; Urban 1970; VanDruff 1971; Sonenshine and Winslow 1972; Lehman 1977*; Keeler 1978; Lehman 1980*; Orloff 1980*; Slate 1980*; Rabinowitz 1981; Jacobson 1982; Nottingham et al. 1982; Lehman 1984*; Moore and Kennedy 1985; Leberg and Kennedy 1988; Perry et al. 1989; Hasbrouck 1991; Kennedy et al. 1991; Hable et al. 1992; Nixon et al. 1993*). The high rural density of 250/km² reported by Twitchell and Dill (1949) may be an anomaly for rural populations as it too was 4-200 times greater than the other reported rural densities at 0.9-55.6/km². Rosatte et al. (1992b) and Rosatte (2000) demonstrated the patchiness of Raccoon densities in urban habitats when large areas are trapped. Many of the high densities reported, including our observations, involved small urban parks presenting large numbers of Raccoons. Densities outside HTBSP were probably much lower.

High densities of Raccoons at HTBSP posed a concern for various reasons. First, a number of diseases are endemic in raccoon populations, in particular, rabies (Winkler and Jenkins 1991). Raccoons are the most common vectors of rabies in the U.S. (Krebs et al. 2001), and two-thirds of all rabid animals in Florida have been Raccoons (Burridge et al. 1986). A large number of uncommonly reported species have been found rabid in association with Raccoon rabies epizootics (Burridge et al. 1986), in

part due to Raccoon usage of urban resources (Winkler and Jenkins 1991). Urban Raccoons are of particular concern for wildlife disease control (e.g., Broadfoot et al. 2001). Most human exposures have been largely due to failure to apply common sense in interacting with Raccoons (Jenkins and Winkler 1987; Jenkins et al. 1988). It follows that a high-density Raccoon population in an urban setting, especially where people have become enamored of them or accustomed to feeding them, as at HTBSP, presents a high-risk recipe for human exposure to rabies during an outbreak (e.g., Kappus et al. 1970; Jenkins and Winkler 1987; Jenkins et al. 1988). We would not expect future high-density urban Raccoon situations in Florida to be addressed with a trap and relocate program due to legal and wildlife management issues. However, if another exception is made, all animals should be vaccinated for rabies prior to release (Rosatte et al. 1992b); otherwise there is a danger of artificially spreading rabies as has been reported previously (Jenkins and Winkler 1987). Ear-tagging would help monitor their movements post-release.

In addition, Raccoons in Florida have become an example of an abundant native vertebrate that impacts the conservation of endangered species (e.g., Garrott et al. 1993) as they cause substantial destruction of sea turtle nests in Florida and throughout the southeastern United States (Stancyk 1982; Engeman et al. *in press*), as well as to shore-nesting birds such as terns and skimmers (Rodgers et al. 1996; Thompson et al. 1997). High density urban Raccoon populations in close proximity to beaches where nesting takes place may provide a reservoir of animals that artificially intensifies predation (Engeman et al. *in press*), and requires predator management to reduce their negative impacts (e.g., Reynolds and Tapper 1996; Hecht and Nickerson 1999).

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